Aug. 18, 1931. J. A. SMITH 1,819,130

ELECTROPLATING AND ELECTROPLATING APPARATUS

Filed April 19, 1926 4 Sheets-Sheet 1

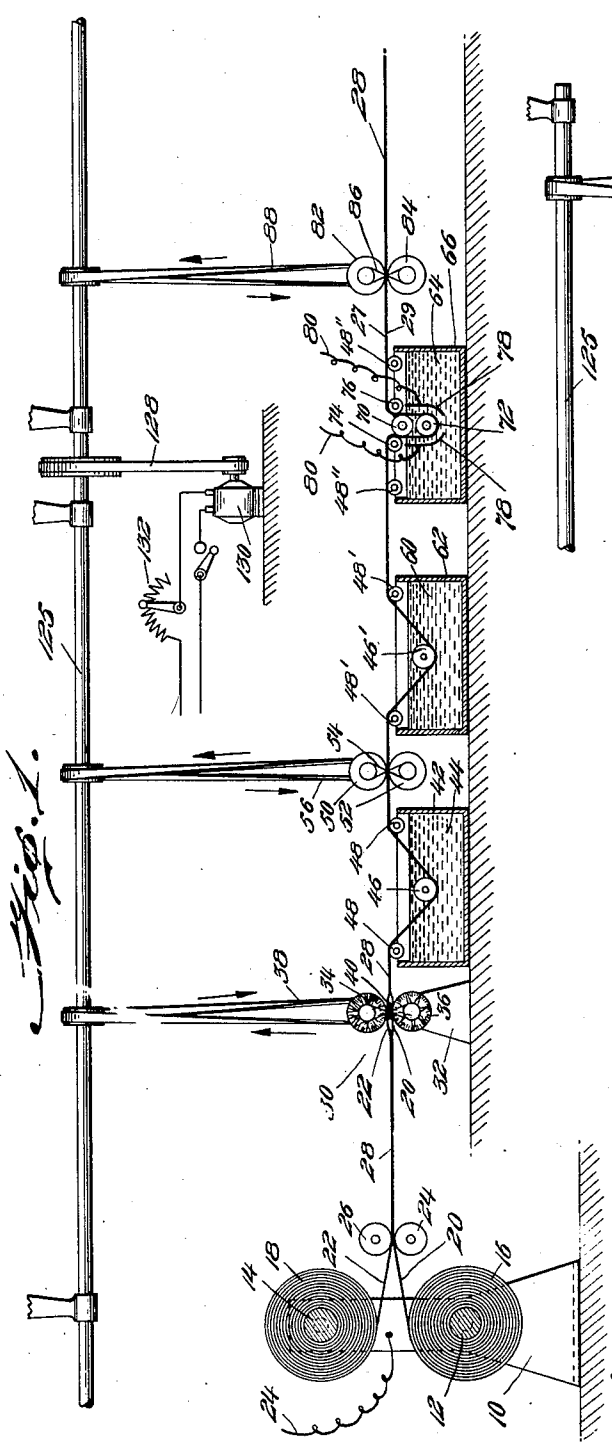


Fig. 1.

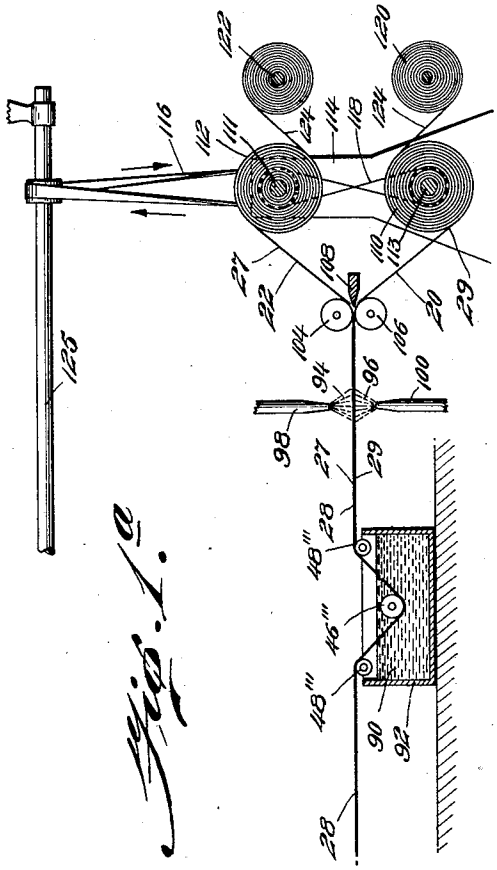


Fig. 1a.

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ELECTROPLATING AND ELECTROPLATING APPARATUS

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Fig. 2.

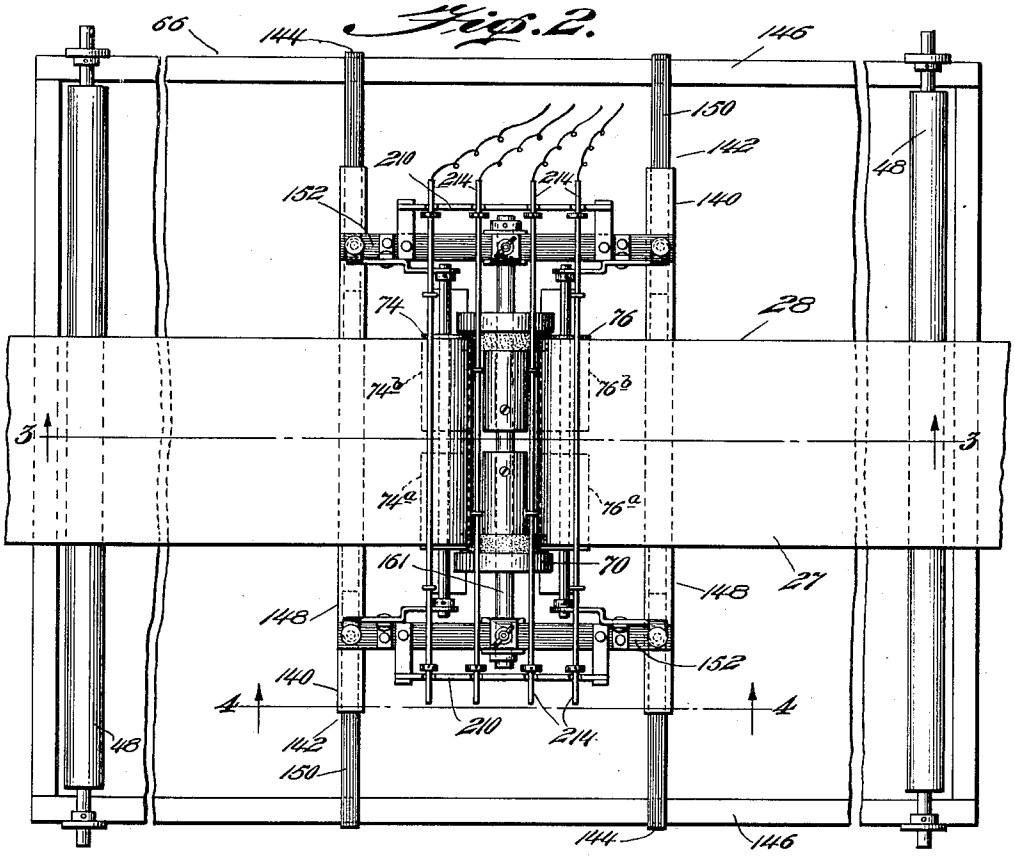
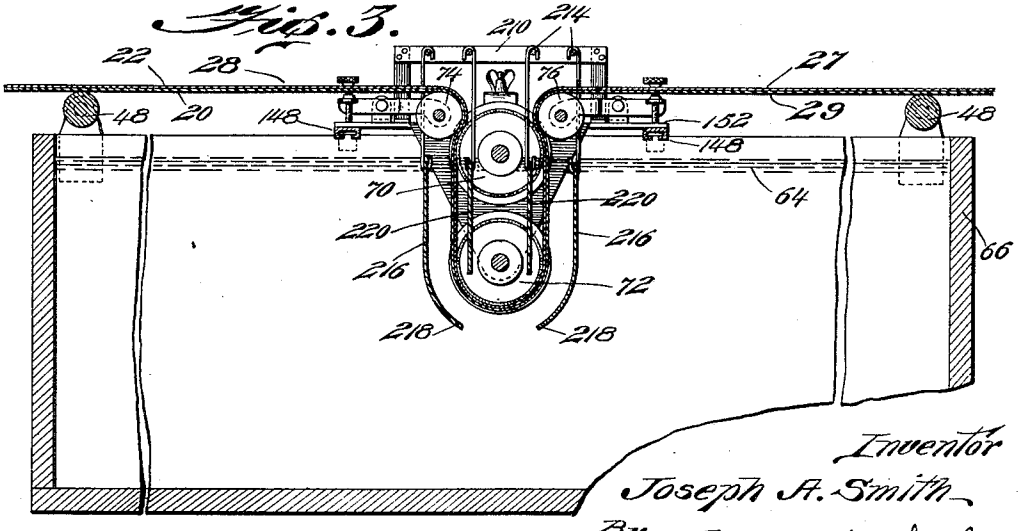


Fig. 3.



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ELECTROPLATING AND ELECTROPLATING APPARATUS

Filed April 19, 1926 4 Sheets-Sheet 3

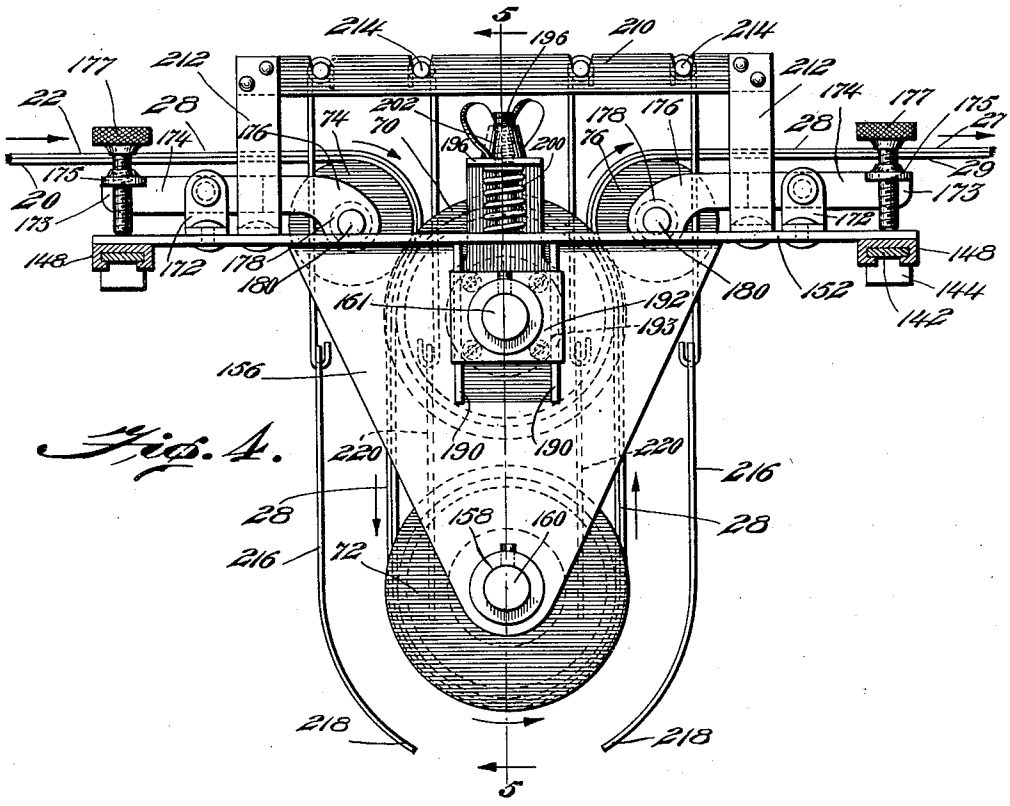


Fig. 4.

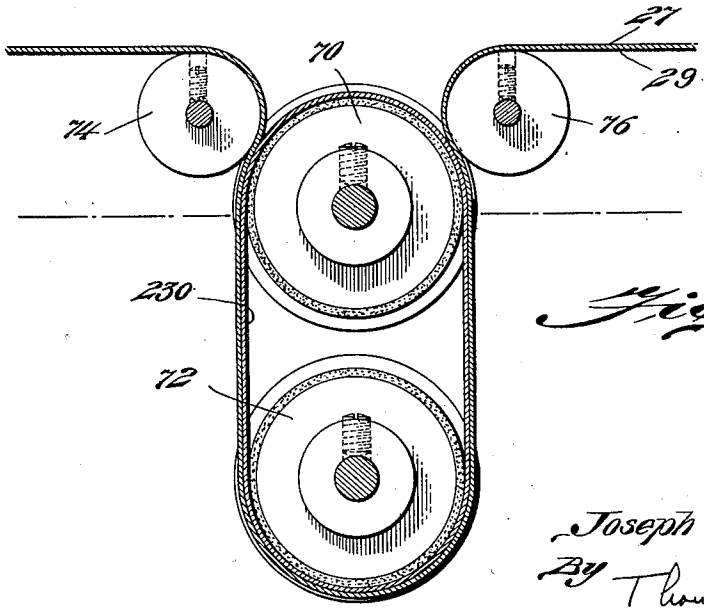


Fig. 6.

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ELECTROPLATING AND ELECTROPLATING APPARATUS

Filed April 19, 1926 4 Sheets-Sheet 4

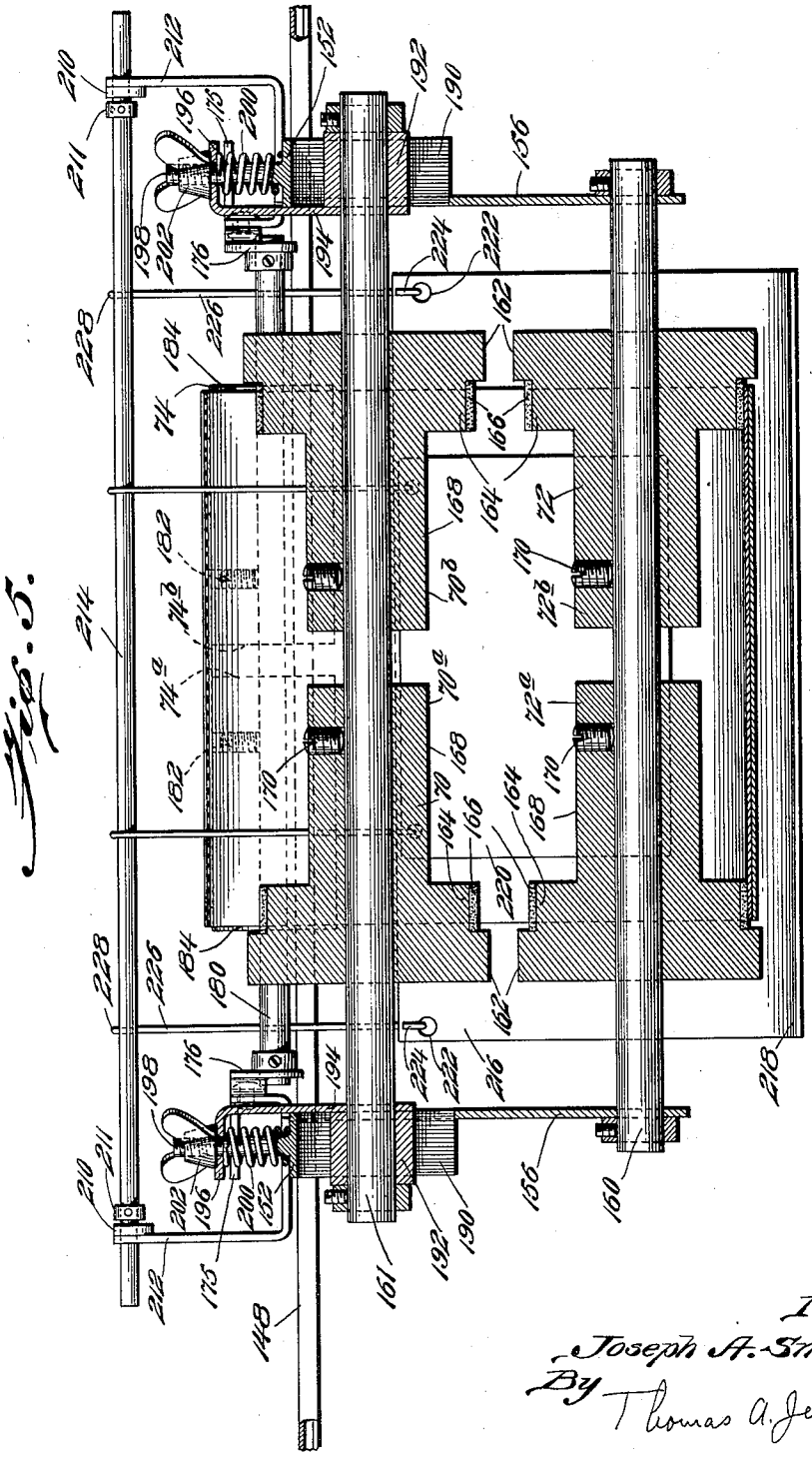


Fig. 5.

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1,819,130

UNITED STATES PATENT OFFICE

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ELECTROPLATING AND ELECTROPLATING APPARATUS

Application filed April 19, 1926. Serial No. 102,970.

My invention relates to improvements in the art of electroplating metal sheets in strip form and includes an improved method and apparatus for this purpose.

I am aware that various types of apparatus have been devised for continuously electroplating strips of sheet material. So far as I am aware however, all former methods have only plated one sheet at a time, and it has been extremely difficult to plate one side of a sheet only. The main object of my invention is to provide an improved method of plating two metal sheets at once on one side only, by retaining said sheets together to form a single sheet of substantially the thickness of the sum of the thicknesses of the two individual metal sheets during passage through the electroplating bath and also if desired through the other necessary steps in the process of electroplating. Electroplating material in strip form on one side only has heretofore been extremely difficult, but my invention not only makes it extremely simple but also substantially cuts the cost in half by electroplating two sheets at once with substantially the same amount of equipment and power. When it has been desired to plate one side only of a metal strip it has been necessary to cover the opposite side with suitable stop offs, the laying and removal of which have been very difficult. Employing my invention the use of these stop offs and the extra expense involved is entirely eliminated.

A further object of my invention is to provide an improved apparatus for accomplishing this result, the specific form of apparatus which I preferably employ being also adapted to plate a single sheet on one side only and which, in fact if desired, may be used to plate a single sheet on both sides.

A further object of my invention is to provide a small compact attachment which may be reduced to a small compass and which may be sold as a unit to be readily attached to any type or size of electroplating bath to plate either two sheets on one side according to the teachings of my present invention, to plate one sheet on one side or to plate one sheet on both sides.

These and such other objects of my invention as may hereinafter appear will be best understood from a description of the accompanying drawings which illustrate embodiments of my invention and mechanism for completely carrying out the improved process thereof.

In the drawings, Figs. 1 and 1ª, which is merely an extension of Fig. 1 due to lack of room on the upper portion of the sheet, are diagrammatic side elevations partially shown in section showing a complete unitary apparatus for carrying out my improved method of simultaneously plating two metal sheets on one side only and provided with a unitary drive.

Fig. 2 is a plan view of an electroplating tank with my improved electroplating attachment attached.

Fig. 3 is a longitudinal sectional view taken along the line 3—3 of Fig. 2.

Fig. 4 is an enlarged longitudinal sectional view taken along the line 4—4 of Fig. 2.

Fig. 5 is a transverse sectional view taken along the line 5—5 of Fig. 4.

Fig. 6 is a longitudinal sectional view of my improved apparatus modified so as to plate a single sheet of material on one side only.

In the drawings, wherein like characters of reference indicate like parts throughout, as explained, Fig. 1 illustrates an apparatus for carrying out all the necessary steps in continuously electroplating sheet material in strip form, the equipment shown being modified so as to carry out my invention of simultaneously plating two sheets of material joined together throughout the various processes on one side only.

As shown in Fig. 1, 10 generally indicates a suitable stand in which are mounted the shafts 12 and 14 each carrying rolls of sheet material in strip form. In order that each respective sheet 20 and 22 coming from the rolls 16 and 18 respectively may be suitably charged to function as a cathode during the electroplating bath, said frame 10 is suitably connected by the wire 24 to a suitable source of electricity. As said sheets 20 and 22 are drawn from said rolls 16 and 18 respectively,

I preferably provide the guide rolls 24 and 26 to join said sheets 20 and 22 together into a single sheet 28 of substantially the sum of the thicknesses of the two sheets 20 and 22. I employ the word "substantially" in the phrase "substantially the sum of the thicknesses" to include a metal or other continuous sheet or blanket which may be inserted between the two sheets 20 and 22 if desired for traction or other purposes.

To secure a better coating of plated material I preferably polish each side of the combined metal sheet 28 before passing it through the various baths, though if desired the polishing mechanism may be dispensed with. In my preferred embodiment the polishing mechanism 30 comprises the frame 32 having the upper and lower polishing rolls 34 and 36 respectively revolvably mounted thereon, said rolls being suitably driven by the belt 38. If desired to give a better polish, I may temporarily separate the combined sheet 28 into the individual sheets 20 and 22 during the polishing operation, by means of the spacing bar 40 inserted between said polishing rolls. The polishing mechanism 30 is so constructed that the rolls 34 and 36 preferably revolve in opposite directions. The rolls 34 and 36 may consist of bristles, or may be wooden or metal rolls covered with felt or any other polishing material. After passing through the polishing mechanism 30 the two sheets 20 and 22 then again become the single combined sheet 28.

I provide the usual cleansing bath 42 filled with the cleansing solution 44. This cleansing solution is preferably an electric cleansing bath containing a lye solution through which an electric current is passed in the usual manner, though any other suitable type of cleansing bath may be employed. To guide the combined strip 28 through the cleansing bath, I preferably provide the metal guide roll 46 below the level of said bath 44 and the guide rolls 48 on each longitudinal side of said tank above the level of said bath 44, though any suitable means for guiding the sheet 28 through said bath may be provided.

After passage through the cleansing bath 44, the combined strip 28 is then passed between the traction rollers 50 and 52, the traction roller 52 being driven in a reversed direction by means of the cross belt 54 connected to said traction roller 50, said roller 50 being driven by the belt 56 in a manner to be explained. It is obvious that these traction rollers provide means to draw the individual strips 20 and 22 off the rolls 16 and 18 between the guide rolls 24 and 26 to form them into the combined sheet 28, through the polishing mechanism 30 and through the cleansing bath 42. Though in my preferred embodiment I have shown the traction rollers 50 and 52 inserted at this particular point, it is obvious that they may be inserted at any convenient point.

After the combined strip 28 has come out of the cleansing bath 42 to clean it of all lye or any other impurities it is preferably passed through the running water bath 60 suitably contained in the tank 62. The combined strip 28 may be guided through the running water bath 60 by the guide rolls 46′ and 48′ arranged similarly to the guide rolls 46 and 48 in the cleansing bath.

The combined sheet 28 then having been thoroughly cleansed and washed is now ready for electroplating and is passed in a manner to be described, through the electroplating bath 64 suitably contained in the electroplating tank 66. Said tank 66 is preferably provided with guide rolls 48″ similar in construction and function to the guide rolls 48 in the cleansing bath. Said tank 66 is also provided with upper and lower guide rolls 70 and 72 respectively and the cooperating pressure rolls 74 and 76 respectively adapted to compactly retain said sheets 20 and 22 together in the combined sheet 28 during passage through said bath, it being more essential that the sheets 20 and 22 are held firmly together during passage through the plating solution 64 than in any other step in the process. The detailed construction of the guide rolls 70 and 72 and pressure rolls 74 and 76 will be described more in detail later. The electroplating tank 66 is also provided with the anodes 78 suitably connected by the wires 80 to any suitable source of electricity. Where it is desired to plate each side of the combined metal sheet 28, the guide rolls 70 and 72 and pressure rolls 74 and 76 are preferably constructed so that each side of each sheet may be properly plated in a manner that will be explained in detail later.

I then provide the additional set of traction rollers 82 and 84, the roller 84 being preferably driven in an opposite direction to that of the roller 82 by means of the cross belt 86, the roller 82 being driven by the belt 88. It is thus obvious that the traction rollers 82 and 84 draw the combined sheet 28 through the running water bath 60 and the electroplating bath 64.

After the combined sheet 28 has been passed between the traction rollers 82 and 84, it is preferably given a final wash by passing it through the final wash bath 90 located in the tank 92 (see Fig. 1ª). Said tank 92 is preferably provided with the guide rolls 48‴ and the central guide roll 46‴ identical in construction and function with the guide rolls 46 and 48 in a cleansing bath 44, though it is obvious that any other suitable means may be provided for guiding the combined sheet 28 through the final wash bath 90.

It is obvious that during immersion in the plating bath that the outer sides of the com-

bined sheet 28 are covered with the electrodeposits 27 and 29.

After drawing the combined sheet 28 from out of the final wash bath 90 it is obvious that it is desirable to dry each plated surface of the combined sheet 28. Though any suitable means may be provided for this purpose, I preferably employ the air blasts 94 and 96 discharging from the tubes 98 and 100 respectively on the outer plated surfaces 27 and 29 respectively.

Then usually it is necessary to provide some means to separate said combined sheet 28 again into the individual sheets 20 and 22 respectively. At this point in the operation, I preferably provide the guide rolls 104 and 106 to keep said sheets 20 and 22 together as the combined sheet 28 through the drying operation. After passage between said guide rolls 104 and 106 respectively, I preferably provide the wedge shaped bar 108 to assist in separating the sheets.

I then preferably simultaneously wind each individual sheet 20 and 22 respectively into a respective roll 110 and 112. I preferably mount the roll shafts 111 and 113 on the frame 114, the roll shaft 113 being mounted underneath the roll shaft 111. The roll shaft 111 is driven by means of the belt 116 and the roll shaft 113 is driven in the opposite direction by means of the crossed belt 118 from the roll shaft 111. It is thus obvious that the roll 112 will be wound in one direction with the plated layer 27 outermost and that the roll 110 will be revolved in the opposite direction with the plated layer 29 outermost. I also preferably mount means to insert a layer of protective material such as paper between successive convolutions on the rolls 110 and 112. For this purpose I preferably mount the paper rolls 120 and 122 adjacent to said rolls 110 and 112 respectively so that a layer of paper 124 may be wound in the right direction between adjacent layers on said rolls 110 and 112 respectively.

As explained, I provide means to simultaneously draw said metal sheets 20 and 22 as the combined sheet 28 through the polishing mechanism, baths, and drying means and to simultaneously wind each sheet into a roll. In my preferred embodiment said means comprises the traction rollers 50 and 52 and traction rollers 82 and 84 respectively and winding rolls 110 and 112 respectively suitably driven by the belts 56, 88 and 116 respectively all attached to a common shaft 125. The belt 38 which drives the polishing mechanism may also be attached to said common shaft 125 so that the polishing mechanism may be revolved in synchronism therewith. The shaft 125 may be driven in any suitable manner, as in my preferred embodiment by the belt 128 revolved by the motor 130 which may be controlled if desired by a rheostat 132.

It is also obvious that the means I have provided to retain the sheets 20 and 22 together so that they form the combined sheet 28 substantially the sum of their thicknesses during passage through said polishing mechanism, baths and drying means comprises the guide rolls 24 and 26, the traction rolls 50 and 52, the guide rolls 70 and 72, the pressure rolls 74 and 76 cooperating with said guide rolls 70 and 72, the traction rolls 82 and 84 and the guide rolls 104 and 106, though it is obvious that said sheets may be retained together as a single sheet by any suitable means during said operations. It is obvious that the combined metal sheet 28 suitably charged as explained by the wire 24 attached to the frame 10 may function as the cathode of the electroplating bath 64. Though I have shown said sheets 20 and 22 joined together in the combined sheet 28 during passage through said bath and other operations by means of pressure it is obvious that they may be retained together in any suitable manner. It is also obvious that where an especially fine product is not desired the polishing mechanism 30 may be dispensed with as well as the layer 124 of protective material between each wind on the rolls. It is also obvious that instead of winding said sheets 20 and 22 upon rolls they may be subjected to any other operations instead. If desired prior to winding into the rolls 110 and 112, the plated layers 27 and 29 may be subjected to further heat or other treatments. It is also obvious that the winding rolls 110 and 112 serve in conjunction with the wedge shaped bar to function as means to separate the said sheets 20 and 22 from the combined sheet 28.

I will now explain the preferred embodiment of the means I employ to hold the two sheets 20 and 22 together into a combined sheet 28 substantially flush throughout their width during passage through the electroplating bath 64. For this purpose I provide an attachment containing all the necessary apparatus therefor which is adjustable to fit any size tank or any width of sheet material and if modified as shown in Fig. 6 may be used to plate a single sheet of strip material on one side only and which may be also used if desired to plate a single sheet of material on both sides only. It is obvious however, that instead of mounting the various portions thereof on the frame adapted to be detachably mounted on the electroplating tank, the various elements thereof may if desired be permanently built right into the electroplating tank.

As shown in my preferred embodiment I preferably provide a frame 140 comprising the transverse bars 142 provided with depending lips 144 at their ends adapted to transversely straddle the tank so that the outer ends thereof adjacent to the lips 144 may rest on the upper edges 146 of the side tank walls. In order that said transverse

bars 142 may be adjustable for any width of tank I preferably construct them with the central hollow sections 148 and the telescoping end sections 150 adapted to telescope within the hollow central sections 148 so that the bars 142 may be readily adjusted for various widths of tank. At points on said transverse bars 142 spaced from each other more than the width of material to be plated, I preferably attach the cross bars 152 in any suitable manner. To the central portions of said cross bars 152 preferably integrally I attach the depending preferably V-shaped brackets 156. I provide the bearings 158 near the lower ends of said brackets 156 in which is revolvably mounted the lower guide roll shaft 160. On said brackets 156 above and spaced a substantial distance from said lower guide roll shaft 160 I preferably revolvably mount an upper guide roll shaft 161. The exact manner of adjustably mounting the upper guide roll shaft 161 shown in my preferred embodiment will be explained in detail later.

As hitherto explained, I provide a lower guide roll 72 and an upper guide roll 70. Though if desired said guide rolls may be mounted in the side walls of the tank, in my preferred embodiment I preferably construct them as follows. Each upper and lower guide roll 70 and 72 respectively comprises the bobbin shaped roll 70 and 72 each of which is provided with the guiding flanges 162 on the outer ends thereof. Where my invention is to be used for plating both sides of a sheet or a combined sheet 28 as hitherto explained, I preferably construct the guide rolls 70 and 72 in the following manner. Adjacent to said guiding flanges 162, I provide the narrow annular shoulders 164 preferably covered with a flexible material 166 such as canvas, rubber etc. As will be apparent later this material is also preferably somewhat absorbent. The guide rolls 70 and 72 are provided with the central portions 168 of substantially smaller diameter than the flanges 162 and annular shoulders 164, said central portions being of a substantial length, and where the width of the roll is not adjustable, preferably of substantially the width of the strip material to be plated. As shown in my preferred embodiment, the guide rolls 70 and 72 are preferably split at the centre thereof into the relatively adjustable portions 70^a and 72^a and 70^b and 72^b respectively. Each said portion thereof is laterally adjustable on said shafts 160 and 161 and may be set on said shafts 160 and 161 in any desired position to accommodate varying widths of material 28 by means of the set screws 170.

The upper guide roll 70 is preferably so mounted on the tank 66 that the upper portion thereof will be above the upper level of the bath 64.

As hitherto explained, adjacent to each opposite upper side of the upper guide roll 70, I adjustably mount the pressure rolls 74 and 76 adapted to press against the upper guide roll 70 when the invention is used to plate a combined sheet 28, to firmly retain the combined sheet 28 together during passage through the plating bath 64. While said pressure rolls 74 and 76 may be mounted in any suitable manner on the tank 66, in my preferred embodiment which as just explained is adapted to be used as an attachment for any present type of tank they are preferably mounted as follows. At convenient points on the cross bars 152, I preferably mount the pivot brackets 172 and on the upper ends of said pivot brackets 172 I preferably pivotally mount the pressure roll levers 174. The pressure roll shafts 180 are suitably mounted transversely of said cross bars in suitable bearings 178 on the work arms 176 of said levers 174 adjacent to and parallel with the upper edges of said upper guide roll 70. The pressure rolls 74 and 76 are suitably mounted on said shafts 180. Said pressure rolls 74 and 76 are also preferably split, preferably centrally and each portion 74^a and 76^a, 74^b and 76^b respectively is laterally adjustable on said pressure roll shafts 180 and may be set in any desired position thereon, by means of the set screws 182. It is obvious that the pressure rolls 74 and 76 are preferably adjustable to a length substantially equal to that between the outer guiding flanges 162 of the upper guide roll 70, so that the outer edges 184 thereof may press the outer ends of the sheet 28 against the annular shoulders 164 on said upper guide roll 70 to firmly grip the outer edges of the sheet 28 between them to hold said sheets 20 and 22 under pressure during passage through the bath 64. In practice it is obvious that the sheet 28 is drawn longitudinally of and through the bath 64 over the pressure roll 74, between said roll 74 and one upper side of the upper guide roll 70 around the lower guide roll 72 between said opposite upper side of the upper guide roll 70 and the opposite pressure roll 76 and over said opposite pressure roll 76 and away. As stated the pressure rolls 74 and 76 and the upper portion of the upper guide roll 70 which they abut are above the level of the bath 64 so that the sheet 28 will be under pressure and the respective component sheets 20 and 22 compactly retained together into a single sheet 28 of substantially the sum of their thicknesses during passage through the bath 64. It is also obvious that the guiding shoulders 162 of the upper and lower guide rolls keep the sheets 20 and 22 of even width substantially flush throughout their width during passage through the plating bath 64 so that the combined sheet will be plated on the outer exposed surfaces thereof only. As the central portions 168 of the upper and lower

guide rolls 70 and 72 are of smaller diameter than the gripping shoulders 164, it is obvious that the inner side of the combined sheet 28 may be readily reached by the plating bath 64. The gripping shoulders 164 are preferably very narrow and preferably covered with an absorbant material such as canvas or felt so that the plating bath 64 may pass through them and actually plate the combined strip on the inside of the outer edges thereof. It is obvious that if desired a continuous guiding sheet of any suitable material of greater width than the two sheets 20 and 22 the outer edges of which are desired to be plated may be inserted between them, said sheet being of such a width that the outer edges thereof will compactly register on the shoulders 164, leaving the entire width of the individual sheets 20 and 22 exposed to the complete action of the plating bath on the inner side thereof. In practice however the outer edges of the inner side of the sheet 28 have become sufficiently plated without the necessity of using this extra strip. I have used the word "substantially" in the phrase "substantially the sum of the thicknesses of the two sheets 20 and 22" to include the addition of this extra guiding sheet if desired.

In order that the outer ends 184 of the pressure rolls may press against the shoulders 164 of the upper guide roll 70 in my preferred embodiment and in order that the pressure rolls 74 and 76 may suitably press against the upper guide roll 70 to retain the sheets 20 and 22 together under the desired pressure during passage through the bath 64 I preferably provide the pressure adjustments about to be described. In order that the individual pressure roll shafts 180 may be pivoted on the pivot brackets 172 to adjustably force said pressure rolls 74 and 76 against said upper guide roll 70 in the power arms 173 of said pressure levers 174 I provide the threaded holes 175. In said threaded holes 175 I mount the adjustable thumb screws 177, the lower ends of which are adapted to contact the cross bars 152. It is obvious that by screwing the thumb screws 177 up and down, the pressure levers 174 are rocked so that the pressure of each pressure roll 74 and 76 against said upper guide roll 70 may be individually adjusted.

In order that said upper guide roll 70 may be forced under pressure upwards against the tension rolls 74 and 76, I preferably mount the upper guide roll shaft 161 on the brackets 156 as follows. The upper central portions of the brackets 156 are preferably cut away and at the sides of said cut away portions thereof are provided with a runway comprising the outwardly projecting flanges 190. I provide the journal blocks 192 in which are revolvably mounted the ends of the upper guide roll shaft 161. The sides of said journal blocks are preferably provided with the vertical channels 193 to permit said blocks 192 to slide up and down on said vertical guideways 190. On the inner faces of said journal blocks 192 I preferably attach the right angle plates 194 adapted to project upwards on the inner side of said cross bars 152, the upper ends 196 of said plates 194 projecting at right angles outwards for a purpose to be described. On said cross bars 152 above said journal blocks 192 I provide the vertically extending bolts 198. Said outwardly projecting portions 196 of said plates 194 are provided with holes to receive the ends of said bolts 198 therein. Extension springs 200 are provided, the lower ends of which abut the upper faces of the cross bars 152 and the upper ends of which abut the under sides of the portions 196, the bolts 198 being provided with the thumb screws 202 above said portions 196. It is thus obvious that said compression springs 200 form pressure means to force said upper guide roll 70 upwards against said pressure rolls 74 and 76 by forcing the portions 196 of the plates 194 upwards, said plates carrying with them the journal blocks 192 and guide roll shaft 161. It is also obvious that by turning the thumb screws 202 up and down on said bolts 198 means are provided to adjustably space said upper plating roll 70 from said lower plating roll 72 and thus the pressure rolls 74 and 76 to vary the operative force of said pressure means 200.

As explained, in my preferred embodiment my invention comprises an attachment adapted to be sold as a unit and adjustable for use in any existing type of electroplating tank 66. To this end I have provided my improved attachment with anodes mounted thereon. As shown in my preferred embodiment the anode cross bars 210 are suitably mounted above said cross bars 152 by means of the right angle brackets 212. Said anode cross bars 210 are provided at intervals throughout their length with slots on the upper portions thereof adapted to receive the transverse anode bars 214. In order to secure efficiency in the plating bath I preferably provide inner and outer anodes, the outer anodes 216 having their lower ends 218 preferably curved inwards so as to keep their surfaces equidistant from the run of the sheet 28 through the device. The inner anodes 220 are preferably hung on the inner side of said sheet 28 adjacent to each side of the central portions 168 of smaller diameter of the guide rolls 70 and 72. The inner anodes 220 are also preferably hung so as to be equidistant from the inner surface of the sheet 28 throughout the passage of the sheet 28 through the bath 64, are preferably not curved and of a lesser length than the outer anodes 216. The anode transverse bars 214 are prevented from lateral displacement on the anode cross bars 210 by means of the

washers 211. The anodes are provided at their upper ends with the holes 222 adapted to receive the lower hooked ends 224 of the anode rods 226, the upper hooked ends 228 of which are adapted to be hung at the desired intervals over the anode transverse bars 214. In order that the anodes may be suitably insulated from the frame and travelling cathode 28 I preferably construct the anode cross bars 210 of insulating material.

As stated, the identical construction shown in my preferred embodiment whether it be built into a tank or whether it be adapted to be sold as an attachment may be readily used as shown in Fig. 6 to plate one side of a sheet only by inserting a travelling blanket of canvas or any other suitable material 230 so that it may travel around the upper and lower guide rolls 70 and 72 thereby permitting the sheet 28 to be plated on the outside only. It is obvious that the blanket 230 will keep the entire inner side of the sheet 28 covered during passage through the electroplating bath 64. It is obvious that where the blanket 230 is employed, the guide rolls 70 and 72 may be of a uniform diameter throughout their width interior of the guiding flanges 162.

It is obvious that I have not only provided an improved method of electroplating metal sheets in strip form on one side only, which operates to effectually accomplish its purpose at approximately half the cost of former methods, but also that I have provided an improved electroplating apparatus which may be used to plate metal sheets in strip form on one side only, a single sheet on one side only or a single sheet on both sides only and that I have also provided an attachment which may be sold as a unit and attached to any existing type of electroplating tank to accomplish these results.

It is understood that my invention is not limited to the specific embodiments shown or processes described and that various deviations may be made therefrom without departing from the spirit and scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. The herein described improved steps in the process of continuously electroplating metal sheets in strip form, which comprise moving through and out of a plating bath two metal sheets compressed together in flush relationship throughout their width so that they form a single compressed sheet of substantially the sum of their thicknesses during immersion in said bath, said sheets forming the cathode of said bath, whereby said sheets may each be plated on the outer exposed side thereof only and after withdrawal from the plating bath separating said sheets.

2. The method of continuously electroplating two metal sheets in strip form which comprises superimposing one of said strips on the other, compressing said sheets throughout their width so that they form a single compressed sheet of substantially the sum of their thicknesses, continuously passing said superimposed and compressed strips through a series of cleaning and plating baths, said sheets forming the cathode of said plating bath and being plated on the outer exposed side thereof only, separating the plated strips and then winding each strip into a roll, plated side outermost with a layer of protective material between each wind.

3. The method of continuously electroplating two metal sheets in strip form, which comprises superimposing one of said strips on the other, continuously passing said superimposed strips through a series of cleaning and plating baths, said sheets forming the cathode of said plating bath and being plated on the outer exposed side thereof only, separating the plated strips and then winding each strip into a roll, plated side outermost with a layer of protective material between each wind.

4. The method of continuously electroplating two metal sheets in strip form, which comprises superimposing one of said strips on the other, compressing said sheets throughout their width so that they form a single compressed sheet of substantially the sum of their thicknesses, continuously passing said superimposed and compressed strips through a series of cleaning and plating baths, said sheets forming the cathode of said plating bath and being plated on the outer exposed side thereof only, and separating the plated strips.

In testimony whereof I affix my signature.

JOSEPH A. SMITH.